Canon Norman he published a monograph of the Ostracoda of the North Atlantic and North-western Europe, and also a catalogue of the Crustacea of Northumberland and Durham.

Prof. Brady's scientific work was done at home. Although he restricted his publications mainly to the results of his examination of Entomostraca from collections made in this and other countries—notably Australia and South Africa—his characteristically neat preparations show that he had interests in all groups which came into the field of his microscope. He was a pioneer in marine dredging, and took an active part in the Northumberland excursions of the early 'sixties, and in the 'nineties he was as keen as before.

It was a pleasure to know Prof. Brady, to be his friend, to watch him work and hear him talk on men and things, on politics and related subjects, and those who had not this privilege will find from his addresses to the Tyneside Naturalists' Club that he gave a critical and well-thought-out consideration to the important questions which arose during his long life and that he had decided opinions and was fearless in expressing them.

A. M.

Notes.

WE are particularly glad to see the names of Prof. C. S. Sherrington and Prof. W. A. Herdman in the list of New Year honours. Prof. Sherrington, who has been appointed a Knight Grand Cross of the Order of the British Empire (G.B.E.), is the president of the Royal Society, and is to be president of the British Association for the meeting to be held in Hull in September next; and Prof. Herdman, who has received the honour of knighthood, vacated the presidential chair at the Edinburgh meeting last year. The two leading British scientific organisations are thus most appropriately represented in the honours list. Other honours included in the list are:—*Knighthoods:* Prof. G. E. Cory, professor of chemistry, Rhodes University College, Grahamstown; Dr. G. S. Buchanan, Senior Medical Officer Ministry of Health; and Dr. J. H. Parsons, F.R.S. *K.C.I.E.:* Sir John Biles, professor of naval architecture, University of Glasgow. *C.M.G.:* Dr. R. T. Paton, Director-General of Public Health and President of the Board of Health, New South Wales.

THIS week we begin the publication of a Calendar of Industrial Pioneers, which is intended to supplement the Calendar of Scientific Pioneers which appeared in our columns last year. It is not necessary here to point out the close association that exists between scientific discovery and industrial progress. The two are inseparable. Problems of communication, transport, mining, agriculture, and manufacture depend for their solution on the co-operation of the laboratory and the works. We believe, therefore, that our readers will welcome the series of biographical notes which will recall the great engineers, inventors, manufacturers, and captains of industry who, by the application of the discoveries of the pioneers of science, have extended existing industries, created new ones, or in some other way contributed to the advancement of civilisation.

A CONFERENCE which commenced on December 12 last was held by permission of the Government at the Ministry of Health, at which delegates from the Health Committee of the League of Nations discussed the international standardisation of therapeutic serums and the sero-diagnosis of syphilis. Prof. Madsen, of Denmark, presided, and Austria, Belgium, France, Germany, Italy, Japan, Poland, Switzerland, Great Britain, and the British Ministry of Health, the War Office, and the Medical Research Council were represented, and the business was conducted by sub-committees. As regards diphtheria and tetanus antitoxins, it was considered both possible and desirable that international units should be fixed for these serums, and a scheme of work to establish them was drawn up. As regards anti-meningococcic, anti-pneumococcic, and anti-dysentery serums, various criticisms were made of the present technique for standardising these, and a scheme of new investigations to obtain more uniformity was adopted. As regards the sero-diagnosis of syphilis, a scheme for comparing the results obtained by the Wassermann reaction with those of other methods was drawn up. An official luncheon was given by the Government to the delegates and guests, at which Sir Alfred Mond presided. It is understood that the conference will meet again in six months' time, probably at the Pasteur Institute, Paris, to report progress and to make further recommendations.

THE *Times* of December 24 published a telegram from Delhi announcing that Mrs. Aidie, who is the widow of the late Lt.-Col. Aidie, I.M.S., has discovered a parasite in the salivary glands of the bed-bug, which is probably a stage of the *Leishmania Donovani* parasite of kala-azar. If this important discovery is confirmed it will furnish the final proof of the truth of the theory of Sir Leonard Rogers that the common bed-bug is the carrier of the infection. The human stage of the parasite was first described by Sir William Leishman in 1903, and was found independently by Lt.-Col. Donovan, I.M.S., while in 1904 Rogers cultivated the organism *in vitro* and discovered the flagellate stage of the parasite. In the following year he recorded experiments showing that sterility and a neutral or slightly acid medium, such as he found in the stomach of bed-bugs, were most suitable for this development, while the plan he had advised as early as 1897, of moving healthy coolies out of infected into new lines only a few hundred yards away, had proved so successful in eradicating the disease from tea estates that the infecting agent was not likely to be a flying one, and he pointed out that infection through the ubiquitous bed-bug would explain all the known facts. Major Patton, I.M.S., in Madras next obtained the development of the flagellate stage of the parasite in the guts of bed-bugs, and certain forms believed to be a post-flagellate stage have since been described by Cornwall, Knowles, and others, but the ultimate development and exact mode of infection have hitherto eluded all workers. Mrs. Aidie has worked for a long time at the Pasteur Institute in Shillong with Major Knowles, I.M.S., so there is every reason to hope that the recent announcement will soon be confirmed. Whether it will help much in dealing with the disease is open to doubt, for long ago Dr. Dodds Price carried out Rogers's suggestion to try to destroy bed-bugs in infected coolie huts in Assam, but without much success, while such very good results in dealing with kala-azar by the tartar emetic treatment are now being obtained in Assam that a vigorous campaign on those lines may be expected practically to stamp out the disease within a few years.

The following have been elected officers of the third International Congress of the History of Medicine to be held in London on July 17–22 next:—*President of Honour:* Sir Norman Moore, Bart. *President:* Dr. Charles Singer. *Vice-Presidents:* Sir D'Arcy Power and the presidents of the first two congresses, Dr. Tricot-Royer, of Antwerp, and Drs. Jeanselme and Menetrier, of Paris. *Treasurer:* Mr. W. G. Spencer. *General Secretary:* Dr. J. D. Rolleston.

H.S.H. Prince Albert of Monaco and Prof. G. O. Sars, of Christiania, were elected foreign members of the Zoological Society of London at its monthly meeting on December 21. The secretary reported that there had been 221 additions to the society's menagerie during November, 104 by presentation, 66 deposited, 5 received in exchange, 44 by purchase, and 2 by birth. The gifts included four lions born in India, presented by the Jam Sahib of Nawanagar. The number of visitors to the gardens during November was nearly seven thousand fewer than during the corresponding month of 1920.

The annual meeting of the British Medical Association will be held in the University buildings at Glasgow on July 21–28 next. The first three days of the meeting will be taken up by the annual representative meeting, and in the evening of July 25 the new president, Sir William Macewen, will deliver his presidential address. The remaining three days of the meeting will be devoted to scientific and clinical work. Papers and discussions are being arranged for the morning sessions and clinical and laboratory demonstrations for the afternoons. The scientific proceedings of the meeting will be distributed among nineteen sections, each dealing with a particular branch of medicine. In the evening of July 28 a popular lecture will be delivered by Prof. J. Graham Kerr.

At the next ordinary scientific meeting of the Chemical Society, to be held on January 19, at 8 p.m., Prof. Arthur Smithells will give an account of Langmuir's theory of atomic structure, and will exhibit models. In connection with Sir Ernest Rutherford's lecture on "Artificial Disintegration of Elements," to be given before the Chemical Society on Thursday, February 9, at 8 p.m., it has been decided that visitors will be admitted by ticket only. Fellows of the society will not need tickets for themselves, but those desiring to bring visitors should apply for tickets to the Assistant Secretary, Chemical Society, Burlington House, W.1, not later than January 28. No fellow will be allowed more than two tickets. The lecture will be delivered in the lecture hall of the Institution of Mechanical Engineers, Storey's Gate S.W.1.

An exhibition of industrial heating apparatus, to be held in April of this year, is being organised by the Office Central de Chauffe Rationnelle, Paris, under the patronage of the Société d'Encouragement à l'Industrie Nationale and the Société des Ingénieurs Civils de France. The exhibition will comprise apparatus and material connected with "la conservation et la récupération" of heat, and it will be divided into two sections, one including refractory materials, insulators, etc., and the other apparatus and plant, such as economisers, heat-recovery plants, etc. Every facility will be given for experimental demonstrations of exhibits. Further information may be obtained from M. L'Ingénieur Directeur de l'Office Central de Chauffe Rationnelle, 5 Rue Michel-Ange, Paris, XVI. We are informed that the director will be glad to receive applications to exhibit from British manufacturers.

At a meeting of the Royal Statistical Society on December 20, Mr. E. A. Rusher read a paper dealing with the statistics of industrial morbidity in Great Britain. From a review of investigations on this subject for the past one hundred years, he concludes that (1) age has the greatest influence upon the rate of sickness, and next to this, occupation; (2) occupation has more influence than has either locality or density of population, but the influence of the latter cannot generally be statistically dissociated from that due to occupation; (3) there are no trustworthy statistics in this country of morbidity among female lives; (4) no statistics exist of the sickness experienced by the community at large corresponding to those for mortality published by the Registrar-General. Mr. Rusher advocated a systematic attempt to investigate the data now available through the operations of approved societies under the National Insurance Acts in order to obtain some measure of occupational incidence of sickness analysed into classes of disease.

Col. T. C. Hodson writes in amplification of our condensed report of his remarks in the discussion which took place at the Royal Anthropological Institute on Prof. Elliot Smith's paper on "The Mound-Builders of Dunstable" (see Nature of December 15 last, p. 512) to point out in reference to the distinct forms of disposal of the dead associated with the mounds, viz. (1) burial of a woman and child in a flexed position and (2) cremation, that in India many living races have two—in one case four—different modes of disposing of the dead, varying according to (*a*) cause of death and (*b*) social status of the dead. Col. Hodson also points out that one of the elemental features of Jhum cultivation in Assam is the use of logs of burnt trees as retaining walls to hold up the soil and keep in the moisture, and that Mr. Mills's reference to ignorance of the proper ceremonial as a reason alleged for not adopting terrace cultivation throws an interesting light upon the possibilities of the negative aspect of the evidence with regard to this method of cultivation.

In an elaborate paper published in the Journal of the Royal Institute of British Architects (third series, vol. 28, No. 3, October, 1921) Mr. Jay Hambridge supplies "Further Evidence for Dynamic Symmetry in Ancient Architecture." The paper gives a careful series of measurements of the Parthenon and other Greek temples which are of permanent value. The writer remarks: "The temple at Aegina is older than the Parthenon, older than the Zeus building at Olympia; therefore the finding of a persistent dynamic theme in the structure which is simply a variation of the themes at Bassæ, Olympia, and Athens suggests that symmetry schemes had some sort of ritual significance. And this is borne out by the record from India. About the time of the erection of the Greek temples of the best period, if not somewhat earlier, there existed in India specific rules for sacrificial altar construction. These have survived as the Sulvasutra, or 'rules of the cord,' better, 'rules of the rope.' Some authorities date the Sulvasutra about 800 B.C., others place it at 600, 500, 400, and even 200 B.C. The exact date is immaterial, as the point of importance for us is that these rules describe in detail the construction of the root rectangles which constitute the base of classic Greek proportion."

The year which has just closed will long be remembered for its shortage of rainfall over the British Isles, as well as in many other parts of Europe. At Greenwich Observatory, where records are available for more than a hundred years, there is no previous year since 1815 with so small an amount of rain. In 1921 the total measurement for the twelve months was 12·50 in., which compared with the average 24·41 in. for the hundred years from 1816–1915 is only 51 per cent. of the normal, and compared with the normal for thirty-five years, 1881–1915, in use by the Meteorological Office, viz. 23·50 in., is 53 per cent. of the normal. Compared with the one hundred years' normal, the rainfall in each month was less than the average, but compared with the normal for thirty-five years, January and September had slightly more rain than the average. The month with least rainfall was February, with 0·12 in., followed by July with 0·15 in. In the previous 106 years the year of least rainfall was 1864 with 16·38 in., and this is followed by 1847 with 17·61 in., and 1858 with 17·70 in. The rainfall for the eleven months to the end of November was 68 per cent. of the average in England and Wales, 94 per cent. in Scotland, and 86 per cent. in Ireland. At Tenterden, as representative of Kent, the rainfall for the eleven months to the end of November was 49 per cent. of the average; at Arundel, as representative of Sussex, 53 per cent., and at Oxford 59 per cent. Notwithstanding the wild and unsettled character of the weather at the close of the year droughty conditions continued in the south and south-east of England.

The annual report of the Gresham's School, Holt, Natural History Society for 1921 includes a useful list of the flowering plants found in the neighbourhood of Holt, Norfolk, the work of the botanical section, and a preliminary list of the Hemiptera–Heteroptera of the same district, compiled by the entomological section.

In the *Quarterly Journal of Microscopical Science* (vol. 65, part 4), Prof. Champy and Mr. H. M. Carleton discuss the shape of the nucleus and the various mechanical causes, such as surface tension and the pressure of cytoplasmic inclusions, by which it is determined. They come to the conclusion that the amitotic division which occurs in certain highly specialised nuclei results from the attainment by the nucleus of a degree of differentiation that is incompatible with mitosis.

To the few known cases of flagellate protozoa with trichocysts another has been added by the observations of Dr. W. Conrad, who has found trichocysts in *Reckertia sagittifera,* n.g., n.sp., a colourless Chloromoradine found in an aquarium in the Botanic Garden in Brussels (Bull. Acad. Roy. de Belgique, Classe des Sciences, 1920, No. 11). The organism is about 50 microns in length, and has two flagella, one directed anteriorly and the other posteriorly. In addition to swimming by means of the flagella, the organism can creep by means of blunt pseudopodia, about six in number, which serve also for the capture of food, such as bacteria, flagellates, and algal zoospores. A layer of slender, rod-like trichocysts in the ectoplasm gives this region a fine and regular striation. Trichocysts are not present in the pseudopodia. Close to the insertion of the flagella are two lateral contractile vacuoles which contract alternately and discharge their contents into a median apical vacuole. Food vacuoles, similar in their reaction to neutral red to those of Paramecium, are present in the endoplasm. The nucleus is of the vesicular type, and divides by karyokinesis; cell division is, as usual in flagellates, longitudinal.

The story of Lord Howe Island as told by Mr. Allan R. McCulloch in the *Australian Museum Magazine* (vol. 1, No. 2) is a sad one for the naturalist. Situated three hundred miles to the east of Australia, it was uninhabited by man when discovered in 1788, and, having no indigenous mammals or reptiles, was the home of a vast and interesting bird population which, ignorant of the murderous ways of man, knew not how to protect itself from his ravages. One species, *Notornis alba,* unable to fly, quickly became extinct, and, except for one skin in the Vienna Museum and a few stray notes in journals, nothing is known of this interesting bird. The island is a dependency of New South Wales, and in 1879 was declared a reserve in the hope that what then remained of its fauna would be preserved. Success seemed to have rewarded this excellent measure, but unfortunately rats were accidentally introduced into the island, and the birds' paradise of two years ago has been reduced to a veritable wilderness beyond all hope of recovery. Mr. McCulloch's account of this tragedy is accompanied by excellent photographs and an interesting description of the natural history of the island, with valuable notes on some of the more interesting birds—magpies, woodhens, and mutton-birds.

IN the *Journal of the Federated Malay States Museums* (vol. 10, part 3, June 1921), Major J. C. Moulton publishes the first of a series of articles on Malaysian butterflies, designed to supplement or correct the information of this region given in Seitz's "Macrolepidoptera of the World." The author defines a true Malaysian sub-region as distinct from a wider area, in which a non-Malaysian element is evident, though not necessarily predominant, and defines it as between lat. 10° N., and 10° S., and long. 95° E. and 120° E., thus including the Malay Peninsula, Borneo, Sumatra, and Java, with its adjacent islands. Thirteen new forms and combinations are described. Major Moulton continues the innovations introduced into his earlier papers of printing the sub-specific names in less prominent type than the generic and specific names, and of retaining the author's name for a species even when followed by a sub-specific name. Both courses have since received the approval of the British Association Committee on Zoological Nomenclature. Valuable notes on variations and geographical distribution are given, accompanied by useful keys for the discrimination of species, sub-species, and forms. We may specially note the distinction drawn by the author between "sub-species" and "forms"—the former as geographical races inhabiting separate areas, and the latter as well-defined forms occurring together over a wide range of country.

THE difficult question of the drainage of the Vale of Pewsey, a district now so well known to the aviators of Upavon, is dealt with by Mr. W. D. Varney in the Proceedings of the Geologists' Association, vol. 37, p. 189, 1921. The vale seems to have been excavated originally along the Pewsey anticline of Cretaceous rocks, which provided a line of weakness, by a river flowing eastward from the Cotswolds and escaping southward by the present gap of the Avon, the river that passes through Salisbury to the sea at Christchurch. This stream was beheaded during the growth of the Severn valley, when the other Avon of the district, which flows through Bristol, was working its head backwards and capturing in addition some of the head-waters of the Kennet and the Thames. Mr. Varney's sketch-maps indicate also the recession of the southern coastline and the formation of the Isle of Wight.

IN a lengthy and most instructive article in the *Geographical Review* for October last on the distribution of population Mr. M. Aurousseau directs attention to the fact that three kinds of maps which at present do not exist are much wanted and could be compiled by the geographical survey of countries. The earth-material map would show the following features: Areas of deep drift soils, areas of residual soils, hydrographical information, fuel deposits, and the location and nature of metallic ores and other economic deposits. The power map should show the distribution of the different power resources—wood, wind, water, coal, oil, etc. Finally, the lowlands map would be a topographical map so coloured that the lowlands, even when of small areas as in the case of intermontane deposits, would stand out prominently. Mr. Aurousseau also points out that in taking stock of the world's resources we require to know the expansion ratio of every land—that is to say, the ratio of the extent to which a given area is occupied to the extent to which it may be occupied. He sketches the nature of the geographical survey required in order that this ratio may be obtained.

AN interesting paper on Greek and Roman engineering instruments, read before the Newcomen Society on December 15 last by Mr. R. C. Skyring Walters, illustrates the uses of historical research applied to science. Such research, the product of co-operation between classical scholars and men of science, was also exemplified at a joint meeting of the Textile Institute with the Manchester and District Branch of the Classical Association and Literary and Philosophical Society last November, and it cannot fail to be of great usefulness. In his paper Mr. Walters quotes the description by Vitruvius of the use of the *dioptra, chorabates,* and water levels in surveying by the Greeks and Romans up to about 100 A.D., and he gives sectional drawings showing reconstructions of these instruments, of which no complete example remains. The *groma,* an arrangement of two crossed arms at right angles with suspended plumb lines at the ends, used for setting out straight lines and lines at right angles, is also shown. In the case of the *dioptra* the advanced stage of development in constructive detail which was reached at the time of Hero of Alexandria, is remarkable. The conclusion is that there are many striking points of similarity, not only in the instruments, but also in the methods employed 2000 years ago, with those of the present day.

WE have received an advance copy of a Carnegie Research Memoir published by the Iron and Steel Institute on the constitution of chromium steels by Mr. T. F. Russell. During recent years industrial applications of iron-carbon-chromium alloys have increased, and a paper on this subject, therefore, is welcome. It must be confessed, however, that the present one does not do much to advance our knowledge of chromium steels. The author has confined himself to an examination of a very restricted area of the iron-carbon-chromium ternary system, in which the carbon does not exceed 1 per cent., while the limit of chromium is 12 per cent. It would have been better if he had taken into consideration in the first instance the equilibrium conditions observed in the binary systems iron-carbon, chromium-carbon, and iron-chromium. Without this a scientific interpretation of the effects observed in the ternary system is impossible. It follows, therefore, that many of the data obtained are as yet purely empirical.

WE learn from the *Times* of December 27 that Major Klein is at work on a three-colour printing process in which the chief innovation is in the taking of the colour records. Instead of the usual light-filters attached to the camera he illuminates the object with light of the desired colour obtained by the well-known method of cutting off with opaque screens the light not wanted in a spectrum produced by suitable spectroscopic apparatus. It seems that he proposes to try the effect of reducing the width of the utilised portions of the spectrum so as to get a nearer approach to monochromatic light, and also the division of the spectrum into more than three parts for four or five, etc., colour processes.

IN the December issue of the Journal of the Society of Chemical Industry Dr. G. C Clayton contributes an interesting summary of the effect of the war on the heavy chemical industry. The Leblanc soda industry is stated to be obsolete, and many of the by-products formerly obtained by it have now to be prepared by other methods. One of the main products, caustic soda, is now made either from ammonia-soda carbonate or by electrolysis. The two chief electrolytic processes operated in this country are the mercury process, by the Castner-Kellner Co., and the Gibbs diaphragm process, by the United Alkali Co. In the manufacture of chlorine the Weldon and Deacon processes have been displaced by the electrolytic methods. Electrolytic chlorine is produced by the Castner-Kellner, Gibbs, and Hargreaves cells, and is often liquefied. Chlorates are now made only by electrolysis of chlorides.

M. GOMBERG and C. C. Buchler describe in the August number of the Journal of the American Chemical Society the preparation of benzyl ethers of carbohydrates. Glucose, sucrose, dextrin, starch, and cellulose are readily benzylated, and some of the products may be of technical importance from their colloidal and plastic characters.

Our Astronomical Column.

THE EINSTEIN TOWER.—The *Observatory* for December contains an illustrated article on this tower, which has just been erected in the grounds of the Potsdam Astrophysical Observatory. It contains a vertical telescope of 50 cm. aperture and 14½ metres aperture, fed by a cœlostat. There are two spectrographs, one with a plane-grating of 12½ cm. aperture, the other with two large prisms giving a dispersion of two angstroms to 1 mm. The instrument will be chiefly employed to investigate the presence or absence of the Einstein shift, but it is available for general astrophysical work. It is in charge of Dr. E. Freundlich, under the general control of Prof. Einstein, who has now an appointment at Potsdam. Dr. Freundlich hopes to observe next year's eclipse from Christmas Island, with A. Kohlschütter and Dr. Voûte.

CHANGES IN THE CRAB NEBULA.—One of the very useful researches to which the great American telescopes have been applied is the study of changes in the nebulæ, by comparison of photographs taken at intervals of a few years. The changes have been in many cases unexpectedly large, and imply either relative nearness to the solar system or very high internal velocities.

Mr. Lampland had already reported some changes in the Crab Nebula deduced from seventeen photographs taken with the Lowell 40-inch reflector during a period of eight years. Mr. John C. Duncan gives in Proc. Nat. Acad. Sci., June, 1921, the results of a comparison of two photographs taken with the 60-inch reflector at Mount Wilson at an interval of eleven and a half years (1909 and 1921).

Twelve condensations were selected near the outer contour of the nebula, at tolerably equal intervals. Thirteen comparison stars were chosen, one near the centre of the nebula, the others fairly near the selected condensations. The results may be summed up thus: (1) the motions of the condensations are on the average quite three times as great as those of the stars; (2) while the star-motions are at random as regards direction, those of the condensations are systematically outward from the centre, being greatest at the ends of the long axis of the nebula, where they amount to $2''$ in eleven and a half years, implying a linear speed of 25 km./sec. at an assumed distance of one hundred light-years. There is some (not very certain) evidence of a counter-clockwise rotation of the nebula. The mean motion of all the nebular condensations in eleven and a half years is $+0{\cdot}10''$ in R.A., $+0{\cdot}435''$ in Decl., referred to the mean of the stars.

THE ASTROGRAPHIC CATALOGUE.—The publication of this great work was considerably in arrear even before the war, which, naturally, did not tend to improve the situation. It is satisfactory to note that volumes are now appearing in rapid succession.

Mr. H. B. Curlewis, director of Perth Observatory, West Australia, has catalogued the whole of zone −35°, the numbers of stars in each quadrant being 6879, 24,753, 22,139, 19,277. The paucity in the first quadrant is explained by its proximity to the South Galactic Pole. The magnitudes are given by letters, A denoting 8·5, B 9·0, and so on; the scale used is that of Chapman and Melotte, and differs from that used in earlier Perth volumes.

Mr. T. P. Bhaskaran has produced vol. 4 of the Hyderabad section, which catalogues the whole of zone −20°, the number of stars being 79,590. This volume completes the zone originally allotted to Hyderabad, about half the plates of which had been taken and measured before the death of Mr. Pocock in 1918. The work has been completed on the lines laid down by him. Standard co-ordinates of all stars contained in the Algiers Astr. Gesells. Catalogue are given at the end of the volume.

Señor Leon Herrero, director of San Fernando Observatory, has produced the first half of the catalogue for zone −3° (R.A. 0h. to 12h.). It contains 58,387 stars, and differs from most of the catalogues in containing X_0, Y_0 co-ordinates for all stars, in addition to the measured x, y.